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Epidemiologic features, seasonal variations and false positive rate of acute appendicitis in Shahr-e-Rey, Tehran

Younes Jahangiri Noudeh [a,*], Nader Sadigh [a], Amir Yousef Ahmadnia [b]

[a] *Medical Students Research Committee, Faculty of Medicine, Iran University of Medical Sciences, Hemmet Expressways, Tehran, Iran*
[b] *General Surgery Department, Rasool-E-Akram Medical Center, Iran University of Medical Sciences, Hemmet Expressways, Tehran, Iran*

KEYWORDS
Acute appendicitis;
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Abstract *Introduction:* Appendicitis is the most common acute surgical condition of the abdomen. Age, sex and seasonal variations have been observed in many studies. To describe and find the possible differences in the epidemiology of acute appendicitis in Shahr-e-Rey, we carried out a retrospective study of all patients with acute appendicitis admitted to Shohadaay-e Haftom-e Tir hospital as it is the only hospital in this restricted part of Tehran.
Methods: Using hospital discharge abstract of patients who were admitted with the diagnosis of acute appendicitis from summer 1996 to spring 2004, we studied the demographic features, particularly age and sex, date of admission and final diagnosis of these patients.
Results: During the observation period, 1093 cases were admitted with the diagnosis of acute appendicitis. Of these, 74.4% were males and 6.1% were not actually an acute appendicitis. The age-specific incidence of acute appendicitis has different patterns in male and female. The incidence was highest in males aged 20—29 years whereas in females the highest incidence was observed in 10—19 years age group. A significant seasonal effect was also observed, with the rate of acute appendicitis higher in the summer months ($p < 0.006$). The rate of false positive diagnosis was highest in the patients aged 0—9 years ($p < 0.0001$). Of those correctly diagnosed, 85.5% had uncomplicated acute appendicitis; 8.3% had perforation; and others (6.2%) had acute appendicitis complicated with other situations.

* Corresponding author. +98 214001696.
E-mail address: junesali@yahoo.com (Y.J. Noudeh).

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Conclusion: Appendicitis is more common in males, in those aged 20—29 years, and during the summer months. The age-specific incidence and sex ratio of acute appendicitis give the impression that epidemiologic features of acute appendicitis are different with worldwide data. However, the seasonal variation and false positive rate of acute appendicitis are in a good agreement with other studies.

Introduction

Appendicitis is the most common acute surgical condition of the abdomen[1] and appendectomy is one of the most common operations worldwide.[2] Age, sex, and seasonal variations of acute appendicitis have been observed in many studies, but the reasons for these variations are not yet known.[3] Furthermore, studies of long-time trends in the incidence of appendicitis using routine statistical record of appendicectomies may be hampered because a varying proportion of appendices which are removed are histologically normal. The incidence of acute appendicitis will therefore be overestimated by using hospital discharge data without qualification. This study was conducted to explore the demographic characteristics, incidence, seasonal variations and rate of false positive cases in patients admitted with the diagnosis code of acute appendicitis during an 8-year period.

Methods

Study design

We conducted a retrospective population-based study to assess the demographic features, incidence, seasonal variations and rate of false positive cases in patients admitted with the diagnosis code of acute appendicitis during summer 1996—spring 2004.

Data source

Cases of acute appendicitis were obtained from all the patients admitted to Shohadaay-e Haftom-e Tir hospital with the diagnosis code of acute appendicitis throughout the study period. The main data elements consist of diagnosis code in the admission record and final diagnosis code according to discharge record based on pathological investigation. Age, sex and date of admission were provided by discharge note.

All the patients with the defined area of residence who admitted during summer 1996—spring 2004 with the diagnosis code of acute appendicitis were included in this study.

Pathological study for each case during the whole study period had been completed by a single expert pathologist in the pathology laboratory of the hospital.

False positive was defined as any final diagnosis apart from acute appendicitis or consequences of an acute appendicitis.

Statistical analysis

Using the SPSS software package (SPSS Inc., SPSS for windows release 11.5.0) the data were analyzed. Count and frequency of patient in each gender, age groups and seasons were analyzed. Comparisons between the frequencies were performed using Chi-square test. Rate of false positive finding was calculated and compared in different age groups and genders. Significant level was considered at 5%.

Results

During the observation period, 1093 cases had been admitted with the diagnosis of acute appendicitis. Of these, 74.4% were males (male:female

Table 1 The age specific incidence of acute appendicitis in males and females

Age group	Female, *n* (% of gender)	Male, *n* (% of gender)	Total, *n* (% of total)
0—9	10 (4%)	16 (2.1%)	26 (2.5%)
10—19	102 (41%)	249 (32%)	351 (34.2%)
20—29	61 (24.5%)	322 (41.4%)	383 (37.3%)
30—39	38 (15.3%)	119 (15.3%)	157 (15.3%)
40—49	21 (8.4%)	37 (4.8%)	58 (5.7%)
>50	17 (6.8%)	34 (4.4%)	51 (5%)
Total	249 (100%)	777 (100%)	1026 (100%)

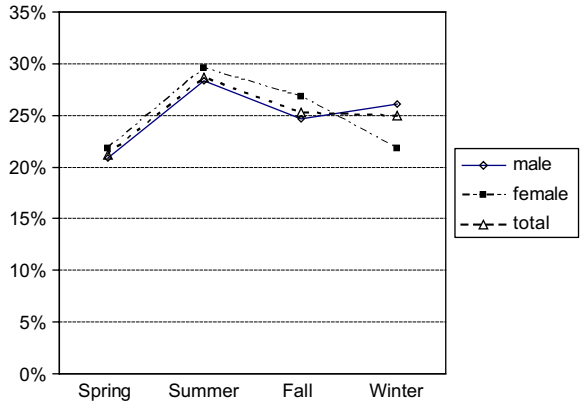

Figure 1

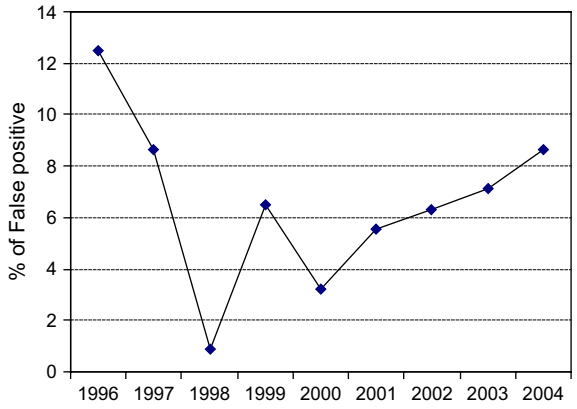

Figure 2

ratio = 2.9). Total false positive rate was 6.1% (11.1% of females and 4.4% of males). Mean (SD) age was 25.5 (14.6) and 25.0 (11.4) years in females and males, respectively. The age-specific incidence had different patterns in males compared to females. The highest incidence of acute appendicitis was seen in 20—29 years age group (37.3%). The incidence was highest in males aged 20—29 years whereas in females the highest incidence was observed in 10—19 years age group ($p < 0.0001$, χ^2 test). In both groups the incidence declined with age increment (Table 1). A significant seasonal effect was also observed, the rate of acute appendicitis was highest in the summer months (28.6%) and the lowest number of cases were been in spring (21.1%) ($p < 0.006$) (Fig. 1). The rate of false positive diagnosis in patients aged 0—9 years was 18.8% that was the highest rate among other age groups ($p < 0.0001$, χ^2 test) (Table 2). The lowest rate of false positive was seen in 30—39 years age group. During years 1996 till 2000 a decrease in false positive rate was observed but since then this rate raised till 2004.

This difference was not significant using Chi-square test ($p \approx 0.14$) (Fig. 2). Using time series transformation function (T4253H smoothing) no significant seasonal variation in incidence of acute appendicitis was observed.

Of those correctly diagnosed, 85.5% had uncomplicated acute appendicitis; 8.3% had perforation; and others (6.2%) had acute appendicitis complicated with other situations.

Conclusion

Appendicitis is more common in males, in those aged 20—29 years, and during the summer months. The age-specific incidence and sex ratio of acute appendicitis give the impression that epidemiologic features of acute appendicitis are different with worldwide data. For example in a study performed by Al-Omran et al. in Ontario, male:female ratio was 1:1.3—1:1.5. The incidence was highest in males and females aged 10—19 years.[3] In another study in a developing country the peak age group was 20—29 years and the male to female ratio of 1.4:1.[4] Moreover comparing with many other studies false positive rates are very low.[1–6] This could be resulted from considering other diagnoses during which alternatively an appendectomy can be performed. This hypothesis can be later confirmed by the study of cases of abdominal pain with a surgical treatment. Furthermore according to this hypothesis high male:female ratio can be explained by this fact that a portion of female patients referring to gynecologist was not included in the present

Table 2 Rate of false positive diagnosis of acute appendicitis in age and sex groups

Age group	Female, *n* (% of age group)	Male, *n* (% of age group)	Total, *n* (% of age group)
0—9	2 (16.7%)	4 (20.0%)	6 (18.8%)
10—19	9 (8.1%)	10 (3.9%)	19 (5.1%)
20—29	9 (12.9%)	13 (3.9%)	22 (5.4%)
30—39	2 (5.0%)	2 (1.7%)	4 (2.5%)
40—49	4 (16.0%)	4 (9.8%)	8 (12.1%)
>50	5 (22.7%)	3 (8.1%)	8 (13.6%)

study. We found a seasonal variation in the total incidence of acute appendicitis but this finding was not applicable to all year of this study. However, total achieved seasonal variation is compatible with previous studies. Presence of a seasonal variation in incidence of acute appendicitis is already discussed in many articles but yet there is no definite explain for it.[3,7–9]

References

1. Liu CD, McFadden DW. Acute abdomen and appendix. In: Greenfield LJ, Mulholland MW, Zelenock GB, Oldham KT, Lillemoe KD, editors. *Surgery: scientific principles and practice*. 3rd ed. Philadelphia: Lippincott-Raven; 1997. p. 1246–61.
2. Blomqvist P, Ljung H, Nyren O, Ekbom A. Appendectomy in Sweden 1989–1993 assessed by the inpatient registry. *J Clin Epidemiol* 1998;**51**(10):859–65.
3. Al-Omran M, Mamdani MM, Mcleod RS. Epidemiologic features of acute appendicitis in Ontario, Canada. *Can J Surg* 2003;**46**(4):263–8.
4. Mungadi IA, Jabo BA, Agwu NP. A review of appendicectomy in Sokoto, North-western Nigeria. *Niger J Med* 2004 Jul–Sep; **13**(3):240–3.
5. Kang JY, Hoare J, Majeed A, Williamson RC, Maxwell JD. Decline in admission rates for acute appendicitis in England. *Br J Surg* 2004 Feb;**91**(2):254.
6. Bakken IJ, Skjeldestad FE, Mjaland O, Johnson E. Appendicitis and appendectomy in Norway 1990–2001. *Tidsskr Nor Laegeforen* 2003 Nov 20;**123**(22):3185–8.
7. Luckmann R, Davis P. The epidemiology of acute appendicitis in California: racial, gender, and seasonal variation. *Epidemiology* 1991 Sep;**2**(5):323–30.
8. Addiss DG, Shaffer N, Fowler BS, Tauxe RV. The epidemiology of appendicitis and appendectomy in the United States. *Am J Epidemiol* 1990 Nov;**132**(5):910–25.
9. Wolkomir A, Kornak P, Elsakr M, McGovern P. Seasonal variation of acute appendicitis: a 56-year study. *South Med J* 1987 Aug;**80**(8):958–60.